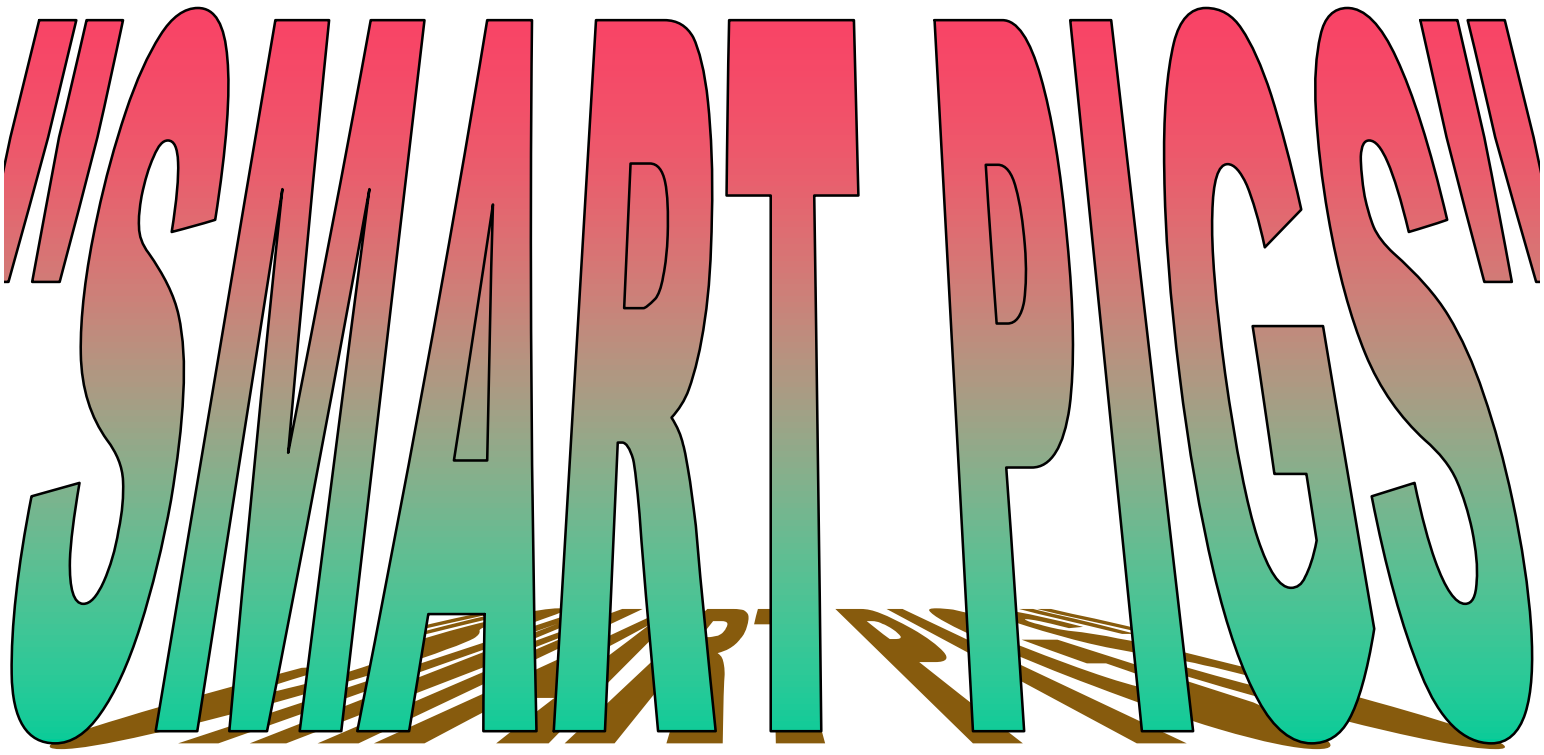

Public Meeting:

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quence Areas”

H. Noel Duc

11/

Brief Evolution of Today's "Smart Pigs".

What Types of "Smart Pigs" are Available T

- **A. Magnetic Flux Leakage**
  1. **Conventional**
  2. **High Resolution (Longitudinal Flux**
  3. **High Resolution (Transverse Flux)**
- **B. Ultrasonic**
- **C. Geometry**
  1. **Caliper**
  2. **Deformation**
  3. **High Resolution Deformation**

General Discussion of Key Elements Relati to Rule Making.

EVOLUTION of “SMART PIGS”

Mid 1960’s - Development of first pig from Shell’s Eddy Current patent. (OPS Formation

First use on-stream as a magnetic flux leakage device (bottom quadrant only) in 19

First 360 degree coverage survey in 1967.

First mandated by OPS as a condition prior reinstating a pipeline back to service - 1969

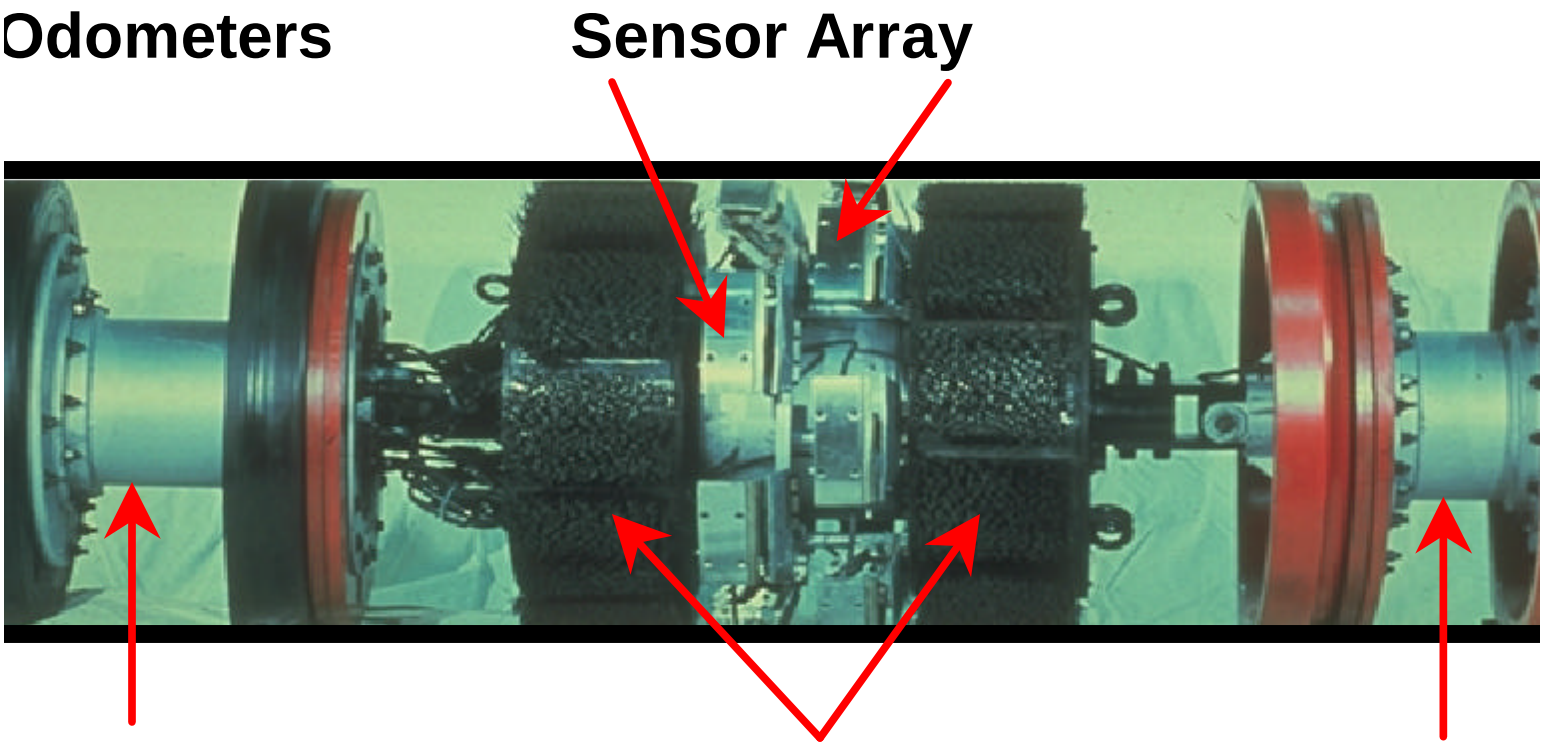
Development of Caliper pigs - Mid 1970’s.

Development of Deformation pigs - Early 19

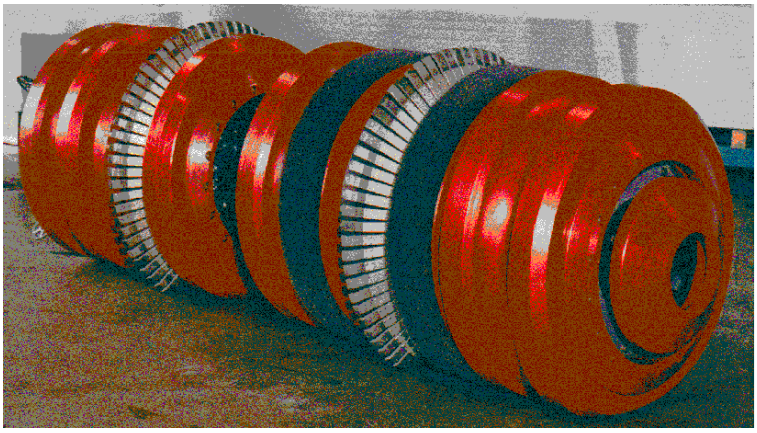
Development of Ultrasonic pigs - Mid 1980’s

Development of Hi Res MFL pigs - Late 1980

Conventional MFL Tool Configuration

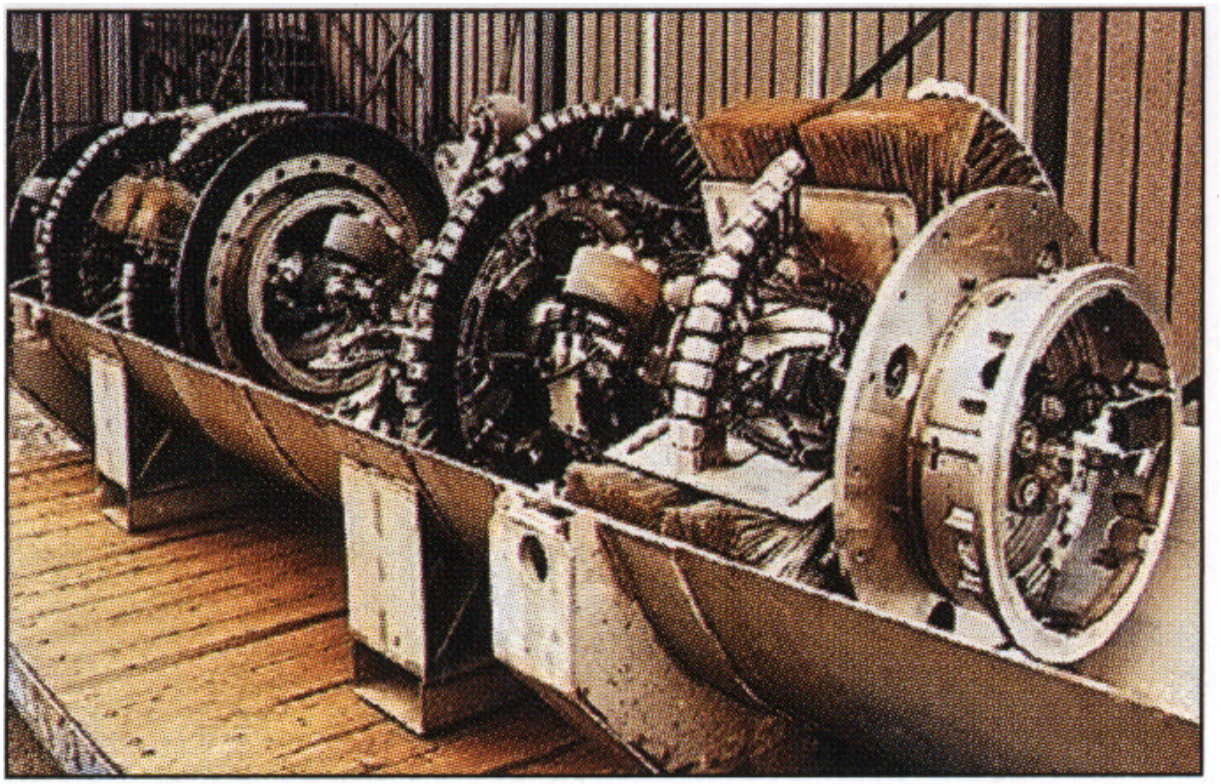


High Resolution Tool Configuration



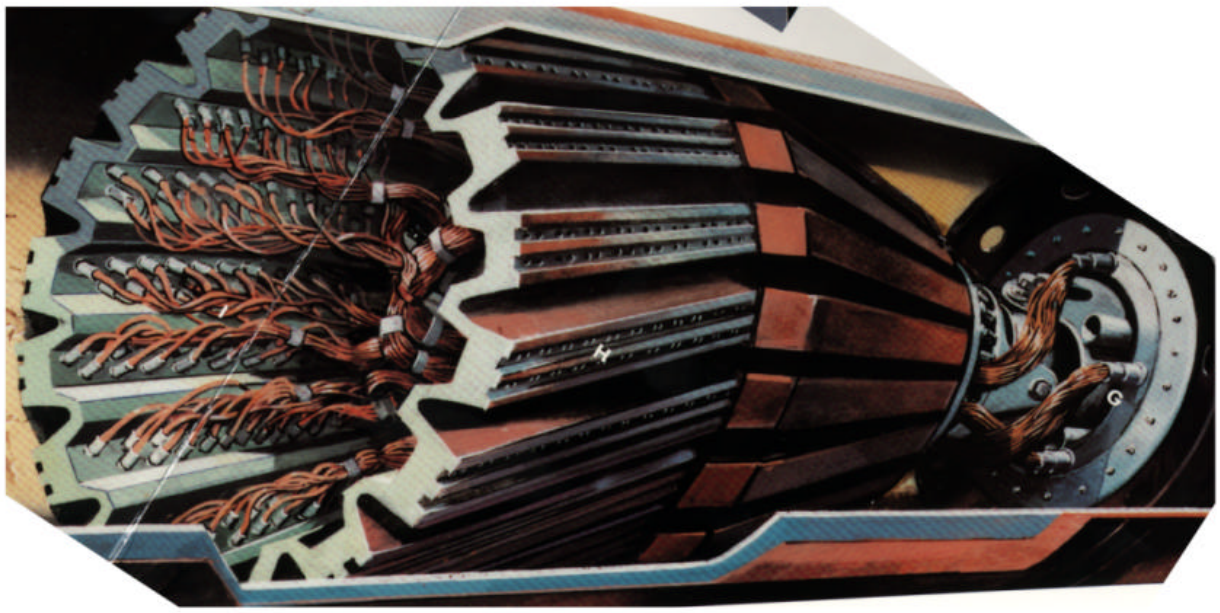
- **Many, Many More Channels**
- **Much Higher Magnetic Levels**
- **Digital Data Acquisition**
- **Greater Reliability**

Transverse Flux Tool Configuration



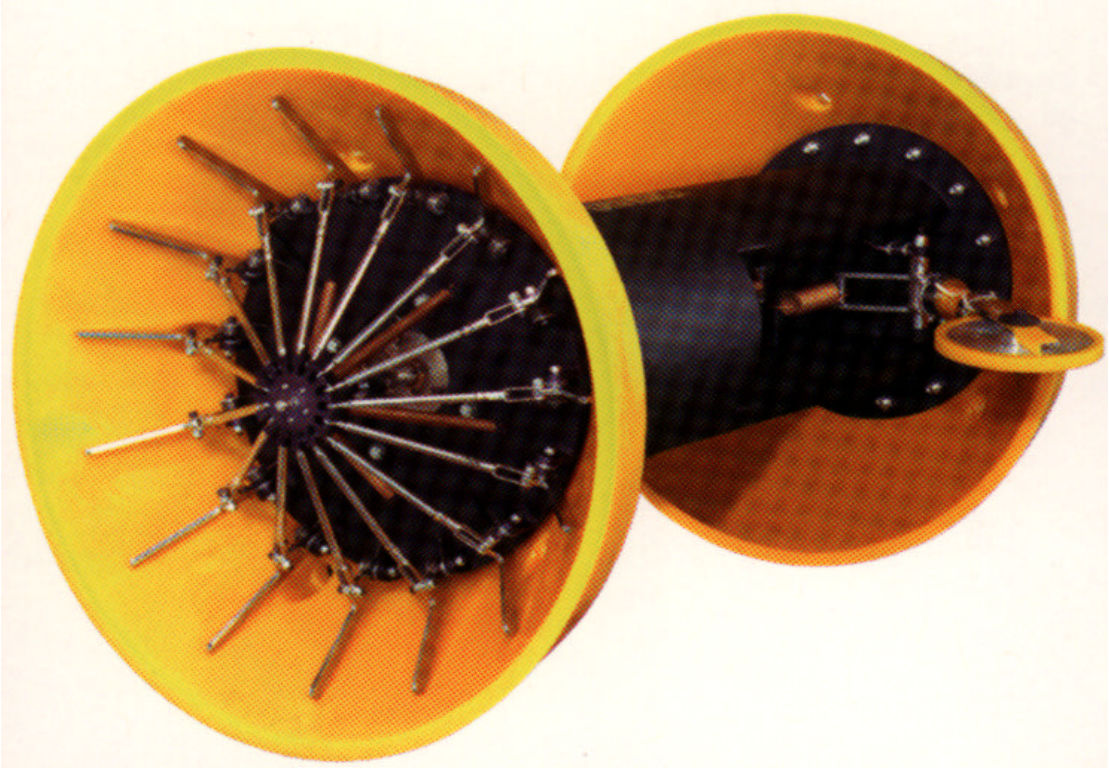
- **Hi Res**
- **Transverse Field**

Ultrasonic Tool Transducer Section



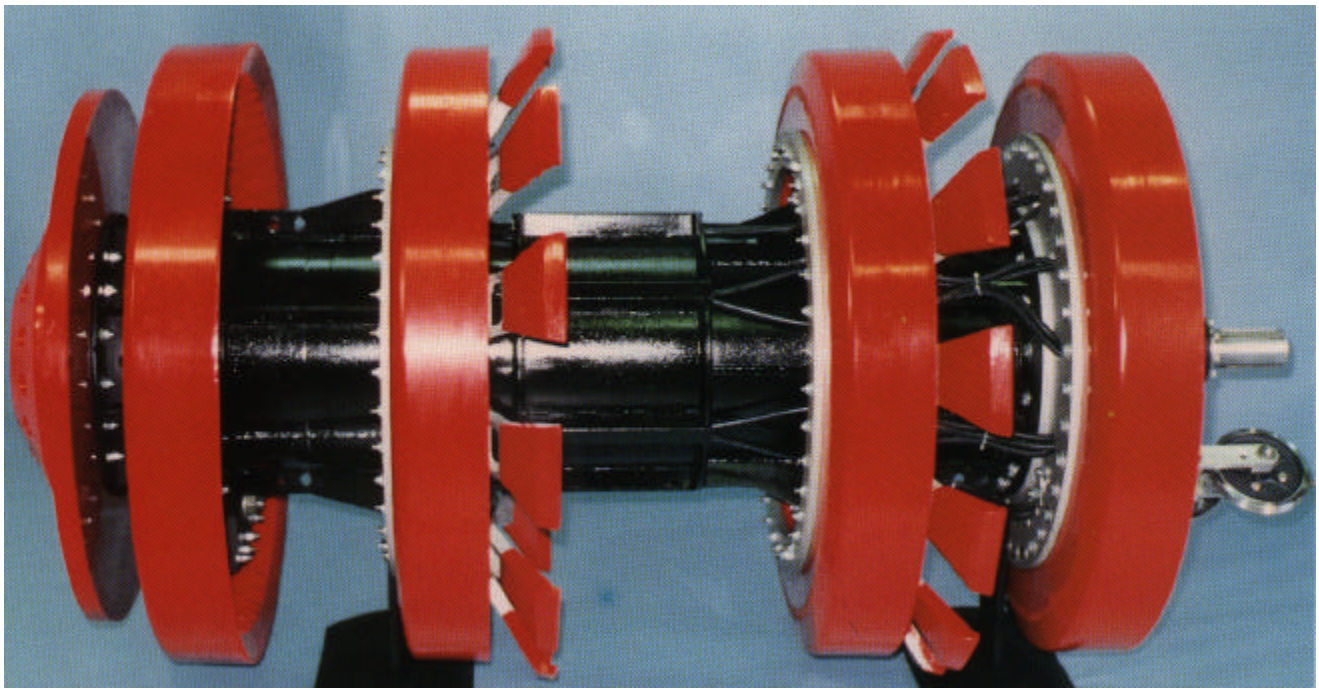
- **Hi Res**
- **Compression Wave UT**
- **Flexible Sensor Array**

Caliper Tool Configuration



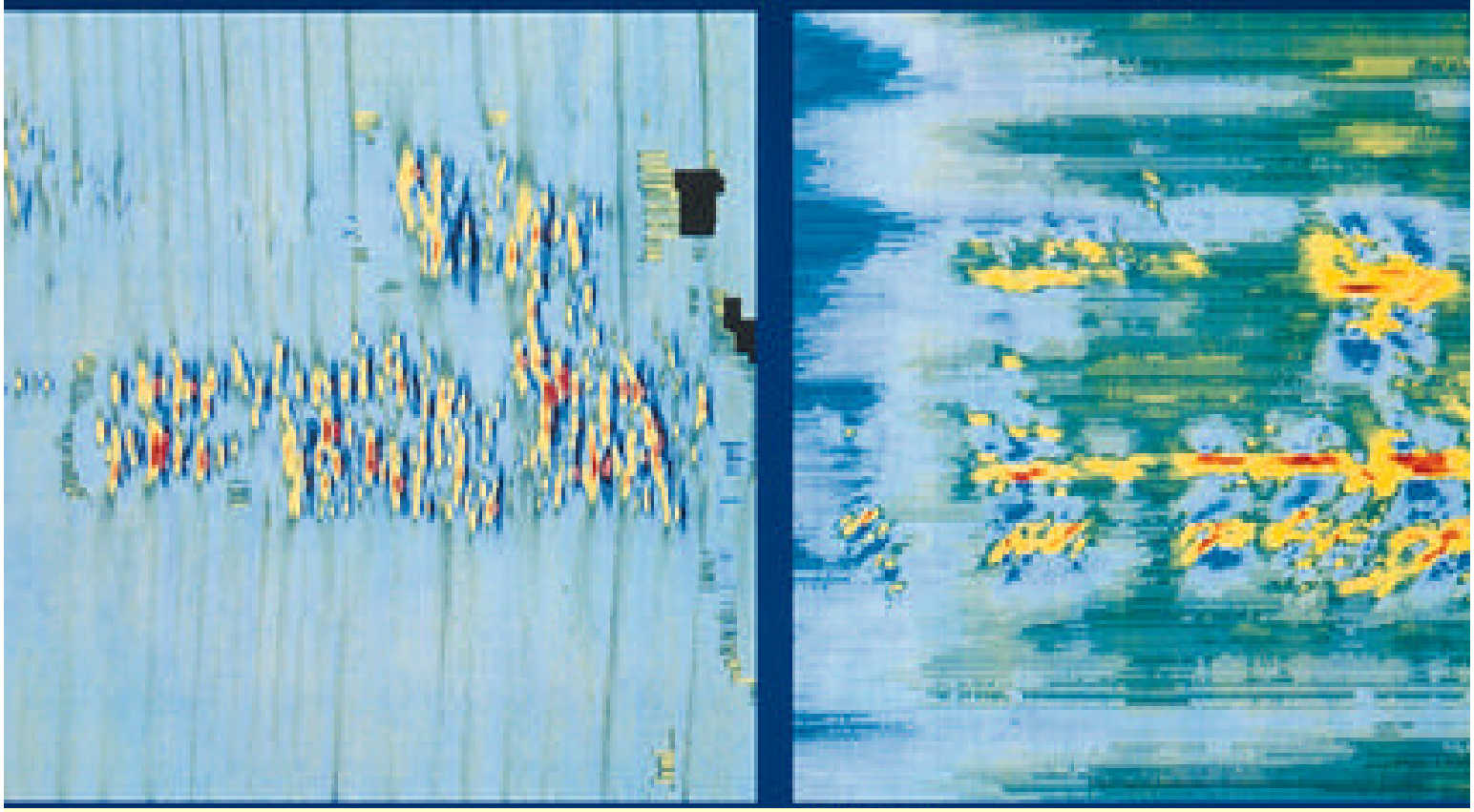
- **Bends**
- **Dents**
- **Buckles**
- **Ovality**
- **Pipewall Changes**
- **Debris Deposits**

Deformation Tool Configuration



- **Precision Deformation Data**
- **Defect Waveform Analysis - 3D**
- **Slope Profile**
- **Circumferential Strain Analysis at Dents**

Hi Resolution Data Comparison



Longitudinal Field

Transverse Field

Same Defect Area

tinent Observations/Opinions:

A broad range of defect types in pipelines dictates use of a broad range of "Smart Pig" types.

Today, pipeline operators that are most effectively controlling integrity are selecting equipment based on specific, confirmed needs unique to their particular situations. Regulatory action should not exclude this flexibility.

A mandate to establish integrity verification prog should be developed defining a minimum numbe elements that are absolutely required coupled wi flexibility to customize each based on specific n

- **“Smart Pigs” should be but one element of an integrated approach utilizing a multiplicity of techniques required to properly describe system integrity on a segment basis.**
- **End result oriented criteria should be used to describe action plans resulting from Smart Pig d**
- **Finite “seek and repair” criteria should be develo as a function of the environment that exists alon each pipeline segment.**
- **Development, implementation, training, and monitoring of the integrity plans will require a substantial investment in resources -- at the operating companies as well as at the Federal and State regulating entities.**

amples of subjective decision parameters th ve proven to be effective in minimizing risks

- Smart pig data that reflects a CHANGE since last surveyed should have priority over all others.
- Smart Pig data that is reflective of mechanical damage and is on the top half of the pipe should have priority over the same located on the bottom.
- Smart Pig data that is abrupt in nature should ha priority over those locations that are smooth.
- Smart Pig data that is longitudinal in orientation should have priority over that which is transvers
- Smart Pig data that covers a large area should ha priority over that contained within a smaller area

Thank You

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